

THE NYMPHS OF *CALOPTERYX AMATA* AND *C. ANGUSTIPENNIS*
(ODONATA: CALOPTERYGIDAE)

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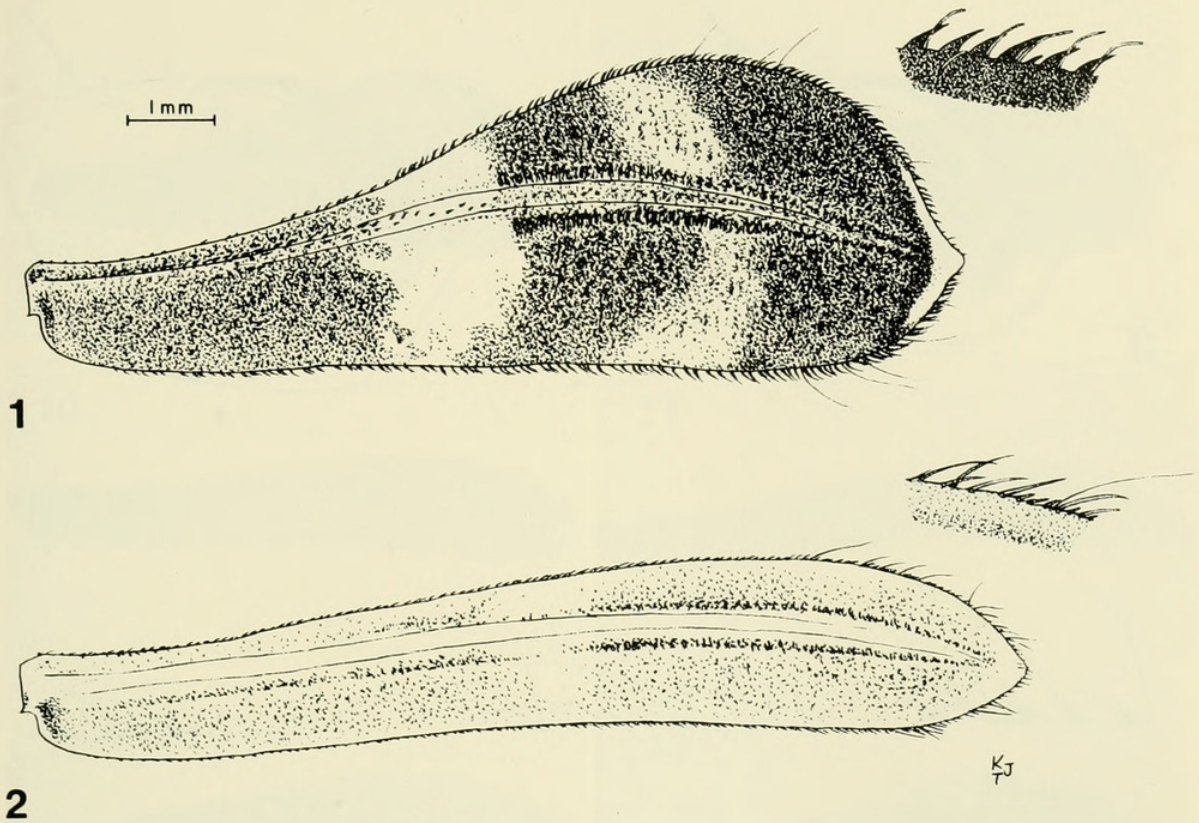
Abstract.—Reared specimens of *Calopteryx angustipennis* (Selys) prove Needham's early supposition (1911) of its nymph was correct. The nymph of *C. amata* Hagen is described for the first time, from reared specimens. A key to the nymphs of the five Nearctic species of *Calopteryx* is given.

Calopteryx nymphs are unique in the North American zygopteran fauna with the combination of antennal segment 1 longer than the remaining 6 segments, triquetral lateral gills, prementum cleft about halfway to base, and lateral carinae of abdominal segments 9 and 10 without a terminal spine. They are restricted to lotic waters ranging from first-order tributaries to medium-sized rivers. Though adults of the five North American species are readily distinguished (Johnson, 1974), nymphs are very similar morphologically. Nymphs of three species are known with certainty, viz. *maculata* (Beauvois), *aequabilis* Say (see Needham, 1903), and *dimidiata* Burmeister (see Wright, 1946—supposition, but subsequently confirmed by several workers). Martin (1939) gave additional differences between *maculata* and *aequabilis*. Needham (1911) described a single immature nymph from Kentucky as *angustipennis* (Selys) by supposition. The nymph of *amata* Hagen has remained unknown.

The purposes of this paper are to show that Needham's supposition of the nymph of *angustipennis* was correct, to describe the nymph of *amata* from reared specimens, and to give characteristics by which the nymphs of the five species may be distinguished.

Nymph of *Calopteryx angustipennis* (Selys)

The median gill and the ratio of antennal segment 1 : head width shown by Needham (1911) for his nymph match characteristics of *angustipennis* nymphs I reared in Alabama and Tennessee. Measurements from 18 final instar nymphs are given to supplement Needham's description: total length 24.5–32.0 mm, head width 4.03–4.35 mm, abdomen length (excluding gills) 16–22 mm, hind femora length 8.7–11.2 mm, median gill length 8.4–10.9 mm, antennal segment 1 length 3.85–4.90 mm. The ratio of the length of antennal segment 2 to segment 1 ranged from 0.21 to 0.23. The shape of the median gill appears to be the most distinguishing characteristic of this species. This gill is widened abruptly beyond the basal third (Fig. 1), and in final instars is 0.6 to 0.7 times the length of the lateral gills; its width is ca. $\frac{1}{3}$ its length. The dorsal and ventral margins have prominent,

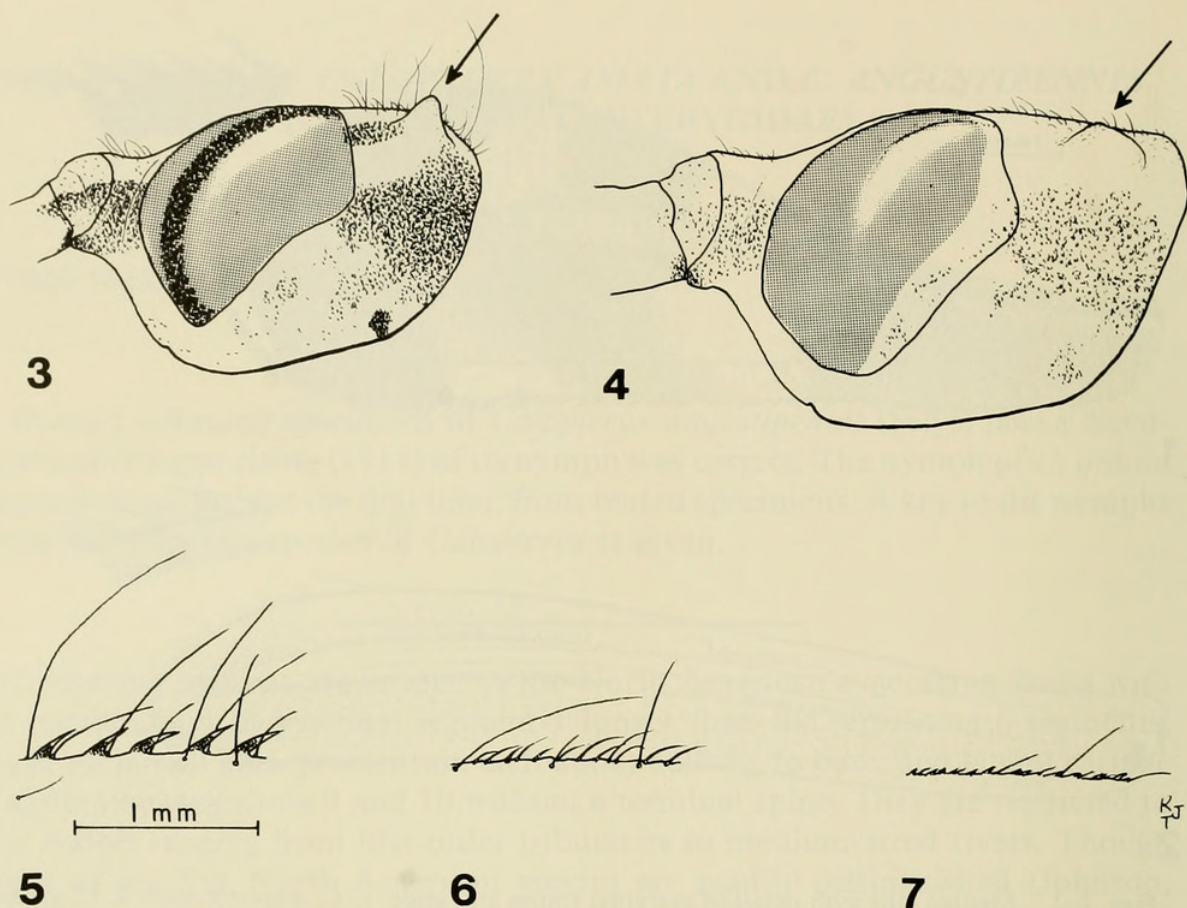


Figs. 1-2. Median gills with detail of marginal spines and setae. 1, *C. angustipennis*. 2, *C. amata*.

stout, curved spines their entire length (Fig. 1). Immediately posterior to each spine is a slender, pale seta; each margin has 4 to 6 much longer hairlike setae beyond midlength. The ventral margin is straight until curved dorsally to the tip. The triquetral lateral gills also have spines along the three margins. The median gill has 3 pale transverse bands, the basal band most evident, the apical band very narrow (Fig. 1).

Material examined.—ALABAMA: Lauderdale Co., Butler Creek, 14 April 1978, KJT, 5 nymphs (2 reared); Winston Co., Sipsey Fork, Bankhead National Forest, 24 April 1981, KJT, 1 nymph. SOUTH CAROLINA: Laurens Co., Durbin Creek, 5 May 1980, KJT, 1 nymph. TENNESSEE: Marshall Co., Duck River, 29 April 1980, KJT, 1 nymph (reared); Maury Co., Duck River, 9-14 May 1980, 5 May 1981, KJT, 8 nymphs (1 reared). WEST VIRGINIA: Mineral Co., Patterson Creek, Burlington, 26 May 1973, P. D. Harwood, 1 nymph (reared); Hampshire Co., Ice Mountain, Slanesville, 26 May 1973, P. D. Harwood, 1 nymph. The West Virginia specimens are in the Florida State Collection of Arthropods.

Five of the *C. angustipennis* nymphs from Duck River, Maury Co., TENN., had 1-9 larvae of *Rheotanytarsus* (Chironomidae) on the exoskeleton. Larval cases were attached to the gills, wing pads, dorsum of abdominal segment 2, femora, dorsum of head, venter of neck, and antennae. These attachments probably are phoretic in nature, as no damage or sign of feeding on the nymphs could be discerned. Very few such examples of a relationship between chironomids and odonates have been reported (see White and Fox, 1979).



Figs. 3-4. Lateral view of head of nymphs. 3, *C. dimidiata*. 4, *C. amata*.

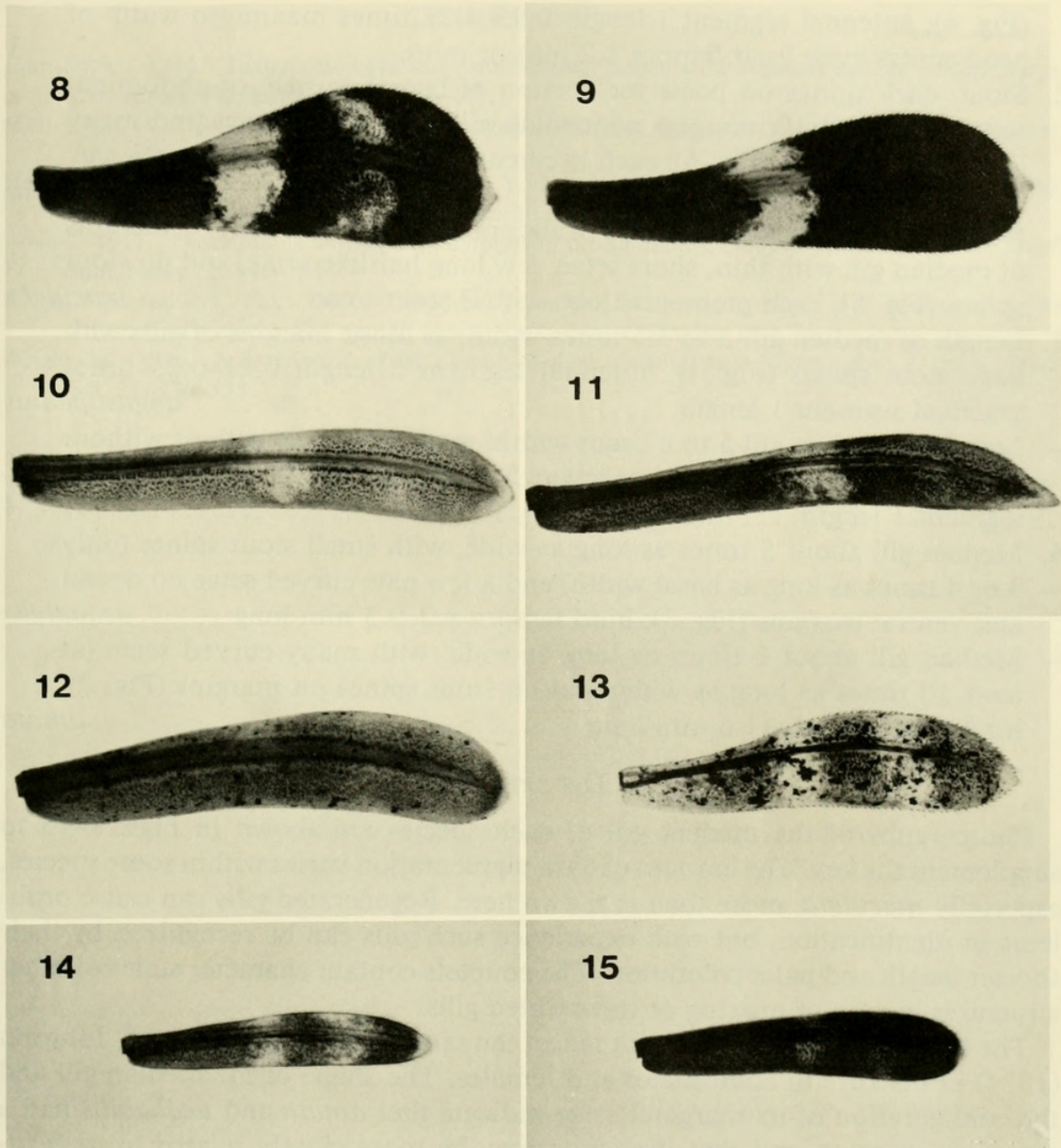
Figs. 5-7. Marginal setae and spines of median gills. 5, *C. dimidiata*. 6, *C. maculata*. 7, *C. aequabilis*.

Nymph of *Calopteryx amata* Hagen

Total length 30.5-33 mm, head width 4.18-4.26 mm, abdomen length (excluding gills) 21-23 mm, hind femora length 10.1-11.6 mm, median gill length 11.3-12.4 mm, antennal segment 1 length 4.6-5.2 mm.

General body color light brown, dorsolateral margins of thorax darker brown. Antennal segment 1 length 1.1 to 1.2 times width of head across eyes; segment 2 length 0.23 to 0.26 times the length of segment 1; segments 1 and 2 light brown, apical $\frac{1}{3}$ or $\frac{1}{4}$ of segment 2 darker brown, remaining segments yellowish-tan to yellow. Tubercle posterior to each eye not elevated above eye level. Prementum similar to *angustipennis*, but each slender lobe with 2 prominent setae, the distal seta smaller.

Tips of wing pads extended to posterior of abdominal segment 4 in last instar. Apical and preapical brown band on legs separated by pale band. Lateral margins of abdominal segments 9 and 10 with ca. 10-14 small, stout, dark brown spines posteriorly, among which are numerous longer and thinner curved yellow setae. Median gill of nearly equal width along entire length, ca. $\frac{1}{6}$ as wide as long; dorsal and ventral margins upcurved slightly, with slender spines and setae interspersed in posterior third by 6 to 10 long hairlike setae (Fig. 2); general color light brown with dark brown spots, a pale area near midlength and at apex. Median gill 0.7 to 0.8 times the length of the lateral gills. Coloration and marginal setae of lateral gills similar to median gill.



Figs. 8–15. Photographs of median gills. 8 & 9, *C. angustipennis*. 10 & 11, *C. amata*. 12, *C. aequabilis*. 13, *C. dimidiata*. 14 & 15, *C. maculata*.

Material examined.—PENNSYLVANIA: Huntingdon Co., Laurel Run, Whipple Dam State Park, 1 May 1960, G. H. & A. F. Beatty, 2 nymphs (reared). WEST VIRGINIA: Randolph Co., Cheat Bridge, Shavers Fork, 22 May 1972, P. D. Harwood, 3 nymphs (1 reared); Tucker Co., Sinks of Gandy, 14 Oct. 1975, P. D. Harwood, 1 nymph. All specimens deposited in Florida State Collection of Arthropods.

KEY TO NEARCTIC *CALOPTERYX* FINAL INSTAR NYMPHS

- 1. Tubercles behind eyes prominent and acute, raised above level of eyes (Fig. 3); antennal segment 1 length 0.8–0.85 times maximum width of head across eyes; hind femora 7.5 mm or less 2
- Tubercles behind eyes low and rounded, not raised above level of eyes

- (Fig. 4); antennal segment 1 length 0.95–1.22 times maximum width of head across eyes; hind femora 8.2 mm or more 3
2. Stout, dark spines on posterior portion of lateral carinae of abdominal segments 9 and 10; margins of median gill with stout spines and many long, hairlike setae (Fig. 5); each premental lobe with one stout seta ... *dimidiata*
- No stout spines on lateral carinae of abdominal segments 9 and 10; margins of median gill with thin, short setae, few long hairlike setae, and no stout spines (Fig. 6); each premental lobe with 2 stout setae *maculata*
3. Length of median gill 3 to 3.5 times width, at most; margins of gills with large stout spines (Fig. 1); antennal segment 2 length 0.21–0.23 times antennal segment 1 length *angustipennis*
- Length of median gill 5 to 6 times width; margins of gills with or without small stout spines; antennal segment 2 length 0.23–0.26 times antennal segment 1 length 4
4. Median gill about 5 times as long as wide, with small stout spines (only 3 or 4 times as long as basal width) and a few pale curved setae on dorsal and ventral margins (Fig. 7); hind femora 8.0–9.3 mm long *aequabilis*
- Median gill about 6 times as long as wide, with many curved setae (at least 10 times as long as wide) and no stout spines on margins (Fig. 2); hind femora 10.1–11.6 mm long *amata*

DISCUSSION

Photographs of the median gill of each species are shown in Figs. 8–15 to supplement the key. The amount of dark pigmentation varies within some species, especially *maculata*, more than is shown here. Regenerated gills can cause problems in identification, but with experience such gills can be recognized by their shorter length and paler coloration. The couplets contain character states of other structures in case of missing or regenerated gills.

The key to the nymphs does not reflect the same affinities as shown by Johnson (1974) in his keys to adult males and females. The shape of the median gill and the configuration of its marginal setae indicate that *amata* and *aequabilis* had a common ancestor, and that *dimidiata* may be more closely related to *angustipennis* than would be surmised from adult appearance. Use of other characters, however, complicates these apparent relationships, and the combination of characters which best depicts the phylogeny of the group is unknown.

Calopteryx amata and *C. angustipennis* appear to have different habitat requirements. *C. amata* has been found almost exclusively on rapidly flowing, smaller streams where large rocks predominate. *C. angustipennis* generally occurs at riffles of slower flowing, larger streams where gravel and sand predominate. The two species have been collected at two localities on Penns Creek in Pennsylvania (in Centre County at Poe Paddy, and in Union County near Weikert) (Shiffer, personal communication). This stream has both types of habitat.

ACKNOWLEDGMENTS

I thank Clark Shiffer for distribution and habitat notes and for critically reviewing the manuscript, Paul D. Harwood for generously allowing me to examine his reared material, and Minter J. Westfall, Jr. for loans of specimens.

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